Real Physics: Three Statements

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Statement 1: Real Physics is Essential to Graphics



Graphics "Rediscovery" of Physics

Light

...

- Kinematics & Dynamics
- Fluid Mechanics
- Solid Mechanics







"Rediscovery" is necessary:

Tech transfer: physics graphics terms

Demonstrate application of concepts

Simplification to computationally tractable models



Role of Physical Models in Graphics Applications

Image as end product: feature films, games, art

Physical models a useful starting point.

Image a means to and end: design, simulation

Physical models are essential.

What Physical Models Provide:

Compact representation:

parametric functions rather than masses of data

BRDF

Thousands of data points

θι φι θο φο **f**0 0 0 0 .0001
0 5 0 0 .0001
0 10 0 0 .00022

85 175 5 10 .0011

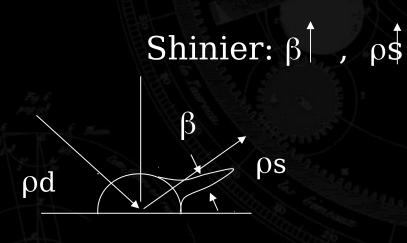
vs. Simple parametric function





What Physical Models Provide:

Parameters: natural to change Useful when image is the end product





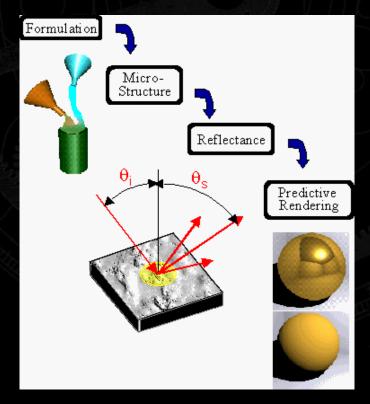




What Physical Models

Provide:Reliable Predictions

Essential when image is a means to an end e.g. Design of coatings



NISTAppearance
Project



Statement 2: Physics "Rediscovery" for Graphics is Complete



"Rediscovery" is finished:

All the major physical disciplines have been explored

Major breakthroughs aren't needed to make use of models from other disciplines



"Rediscovery" is finished:

The goal of graphics is not perfectly accurate physics, we don't need to account for every photon.

The goal of graphics is the perfect image. What would that be???



Statement 3: Perceptual Models are Needed to Apply Physics



Physical Models: Big
Impact
when Image is the
Product: films, gai
Author Decides
"Good Enough"

A Lot of Time +Money



Physical Models Small Impact when Image is the Means to

an End: Design, Simulation Image Must Be

Image Must Be Visually Accurate

Scarce Time + Money

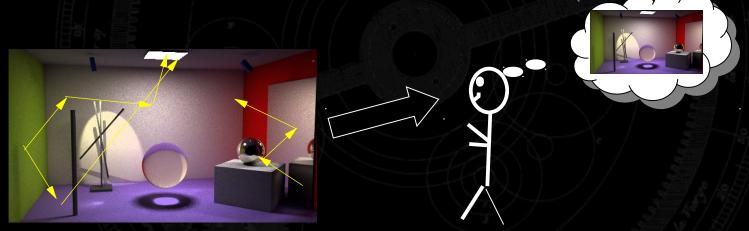
G. Ward Radiance





Making Reliable Images Inexpensively:

Physical Model + Perceptual Model



- Insures that physical model is accurate enough
- Prevents modeling every atom & photon



Successful Perceptual Models:

- Tristimulus Model
- Tone Mapping

Some of the Outstanding Issues:

- Geometry
- Reflectance
- Motion



1. Real Physics is Essential to Graphics

2. Physics "Rediscovery" for Graphics is Complete

3. Perceptual Models are Needed to Apply Physics

